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(54) CONDUCTIVE THERMOPLASTIC RESIN COMPOSITION

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a conductive thermoplastic resin composition which has a small specific gravity and can be manufactured simply without using a special manufacturing apparatus.

SOLUTION: The conductive thermoplastic resin composition has thermoplastic resin as its matrix, a sea island structure whose domain is thermoplastic resin and/or rubber, has thermoplastic resin forming at least a matrix including conductive inorganic fillers.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]About a conductive thermoplastic resin composition, in detail, specific gravity of this invention is small, it is easy to manufacture, and relates to the conductive thermoplastic resin composition which can be used conveniently for a heating element, an electromagnetic shielding material, etc.
[0002]
[Description of the Prior Art]Although rubber and thermoplastics are generally insulating substances electrically, there are many uses of which conductivity is required, and conductivity may be required also for electromagnetic shielding nature etc. Generally as a method of giving conductivity to rubber and thermoplastics, the method of blending a conductive material, for example, metal, and conductive carbon is performed (refer to JP,6-9884,A, JP,6-220323,A, and JP,8-92470,A each gazette). However, when metal, conductive carbon, etc. are blended, there is a problem that specific gravity becomes large and the use part of rubber or thermoplastics obtained is restricted. Although there was also the method of coating the surface of the molded product of rubber or thermoplastics and the film of thermoplastics, and giving conductivity, the special device for surface coating was needed, the production process of a molded product or a film increased, and there was a problem of taking time and effort.
[0003]
[Problem(s) to be Solved by the Invention]Providing the conductive thermoplastic resin composition which can be manufactured simple without specific gravity being small and needing a special manufacturing installation, and by including these constituents further, the purpose of this invention is light and is providing the heating element and electromagnetic shielding material which the time and effort of manufacture does not require.
[0004]

[Means for Solving the Problem]That is, this invention makes thermoplastics a matrix, has the sea island structure which makes thermoplastics and/or rubber a domain, and provides a conductive thermoplastic resin composition which contains a conductive inorganic bulking agent in thermoplastics which forms a matrix at least.

[0005]Volume specific resistance values of said conductive thermoplastic resin composition are 10^{-5} - 10^{3}. It is preferred that it is by [omega-cm].

[0006]It is preferred that said conductive inorganic bulking agent is at least one chosen from a group which consists of a conductive metal and conductive carbon.

[0007]It is preferred that said domain is the rubber by which at least a part was vulcanized.

[0008]This invention provides a heating element containing said conductive thermoplastic resin composition.

[0009]This invention provides an electromagnetic shielding material containing said conductive thermoplastic resin composition.

[0010]

[Embodiment of the Invention]Hereafter, this invention is explained in detail. The conductive thermoplastic resin composition (it is hereafter described as the constituent of this invention) of this invention is a resin composition which makes thermoplastics a matrix (continuous phase), has the sea island structure which makes thermoplastics and/or rubber a domain (disperse phase), and contains a conductive inorganic bulking agent in a matrix at least. In this invention, conductivity is given to the constituent of this invention by blending a conductive inorganic bulking agent with a continuous phase, and forming conductive circuits into a continuous phase. The decrease in specific gravity of the whole constituent of this invention is attained by forming a continuous phase with the thermoplastics of the smallest possible quantity into a constituent as compared with a domain, and forming a circuit for the loadings of the conductive inorganic bulking agent which is generally high specific gravity as a smaller quantity. In the constituent of this invention, the thermoplastics and/or rubber which form a domain into the resin (henceforth matrix resin) which forms a matrix are distributing, and in the constituent of this invention, a matrix forms the continuous phase of mesh shape and exists. This decentralized structure is stable and a decentralized structure does not change with processings by the post process of resin composition manufacture. In the volume of a domain, as compared with the volume of a matrix, thermoplastics and/or rubber form the domain for many stably. Although the volume fraction of a matrix and a domain does not have restriction in particular, the thing whose volume fraction of a matrix is smaller than the volume fraction of a domain is preferred. Specifically, it is preferred that the ratios of the volume fraction of a matrix and a domain are 90 / 10 - 30/70. If it is this range, the volume fraction of the matrix which the high-density conductive inorganic bulking agent mentioned later certainly contains is small, and the constituent of this invention obtained can make small the specific gravity of the

whole constituent of this invention. Here, as for the specific gravity of the constituent of this invention, 2.0 or less are preferred, and 1.3 or less are more preferred.

[0011]The thermoplastics which can be used as matrix resin of the constituent of this invention, There is no limitation in particular and engineering plastics, such as general-purpose thermoplastics, such as polyethylene, polypropylene, polyvinyl chloride, polystyrene, and ABS plastics, nylon, polycarbonate, polyester, polyacetal, a polyvinylidene chloride, and a fluoro-resin, etc. are mentioned. These may be used by an one-sort independent and may use two or more sorts together.

[0012]As thermoplastics which can be used as a domain of the constituent of this invention, For example, engineering plastics, such as general-purpose thermoplastics, such as polyethylene, polypropylene, polyvinyl chloride, polystyrene, and ABS plastics, nylon, polycarbonate, polyester, a polyvinylidene chloride, and a fluoro-resin, etc. are mentioned. In the constituent of this invention, it is preferred to choose the thing from which the thermoplastics and the solubility parameter (SP value) of a matrix differ, or the thing from which polarity differs as thermoplastics of a domain so that a matrix and a domain may dissociate. The thermoplastics used as a domain may be independent one sort, and may use two or more sorts together.

[0013]The rubber which can be used as a domain of the constituent of this invention, There is no limitation in particular and For example, crude rubber, polyisoprene rubber, styrene butadiene rubber, Butadiene rubber, ethylene propylene rubber, isobutylene isoprene rubber, silicone rubber, chloroprene rubber, nitrile rubber, fluorocarbon rubber, urethane rubber, acrylic rubber, chlorosulfonated polyethylene, etc. are mentioned. These may be used by an one-sort independent and may use two or more sorts together. As rubber as a domain, it is preferred to choose the thing from which the thermoplastics and the solubility parameter (SP value) of matrix resin differ, or the thing from which polarity differs so that a matrix and a domain may dissociate. As a domain of this invention, although the above-mentioned thermoplastics and rubber can be used, even if it uses thermoplastics and rubber together, it can also use independently, respectively, without using together.

[0014]The constituent of this invention contains a conductive inorganic bulking agent in matrix resin at least. The conductive inorganic bulking agent contained in a matrix, When it crowds in a matrix and the matrix itself has the continuation structure of mesh shape in the constituent of this invention, A conductive inorganic bulking agent can also hold the continuation structure of mesh shape in the constituent of this invention, as a result, conductive circuits are formed in the constituent of this invention, and the constituent of this invention comes to have conductivity. Especially if it is a bulking agent which has conductivity as a conductive inorganic bulking agent used by this invention, it will not be limited, for example, a conductive metal and conductive carbon are mentioned. As a conductive metal, gold, silver, copper, aluminum,

nickel, palladium, There are metal fibers, such as powdery parts, such as iron, stainless steel, iron oxide (ferrite), tin oxide, indium oxide, lead oxide, silicon carbide, zirconium carbide, and carbonization titanium, brass textiles, aluminum textiles, Cu textiles, and a stainless steel fiber, metal flakes, etc., and all are 10^{-6}. [Omega-cm] It has a volume specific resistance value of a grade.

[0015]It is distinguished and the DBP (dibutyl phthalate) oil absorption of the carbon black used as a bulking agent/a reinforcing agent is [conductive carbon] 90. [ml/100g] As mentioned above, it is 100 preferably. [ml/100g] As mentioned above, it is 150-400 still more preferably. Carbon black of [ml/100g] is said. As such conductive carbon, for example Mitsubishi Chemical #3050B, # Acetylene black by 3150B, #3750B, #3950B, Akzo Ketchen black EC, DJ-600, #4500 by Tokai Carbon Co., Ltd., #5500, and DENKI KAGAKU KOGYO K.K., etc. can be illustrated. Fibrous carbon, such as a carbon fiber and a carbon milled fiber, may be sufficient as conductive carbon. When fibrous, a 0.5-25-mm-long thing is preferred. It is independent, respectively or a conductive metal and conductive carbon may both be added at the resin composition of this invention. Although a conductive inorganic bulking agent is contained in a matrix at least, it may be contained all over the domain.

[0016]The volume specific resistance values of the constituent of this invention containing an above-mentioned conductive inorganic bulking agent are 10^{-5} - 10^{3}. [Omega-cm] is preferred and they are 10^{-3} - 10^{0}. [Omega-cm] is more preferred. If it is this range, the conductivity of the resin composition of this invention obtained will be high, and specific gravity can be simultaneously made small enough. The volume specific resistance value can control the volume specific resistance value of the resin composition of this invention by the loadings of a conductive inorganic bulking agent.

[0017]In addition to the ingredient of above-mentioned Mandatory, in the constituent of this invention, in the range which does not spoil the purpose of this invention. A publicly known additive agent, for example, carbon black for reinforcement other than the above-mentioned conductive carbon, Bulking agents, such as clay, talc, and calcium carbonate; plasticizer;N-phenyl- N', such as paraffin oil -(1,3-dimethyl)- P-phenylene diamine, Antiaging agents, such as N-phenyl-N'-isopropyl-p-phenylene diamine, a thermostabilizer, light stabilizer, lubricant, colorant, etc. may be blended.

[0018]As a manufacturing method of the constituent of this invention which forms sea island structure into the constituent of this invention, and makes a matrix contain a conductive inorganic bulking agent at least, the two following methods can be illustrated, for example.

** Use thermoplastics for both a matrix and a domain, and choose domain resin so that the polarity of the thermoplastics (henceforth domain resin) of a domain may become lower than the polarity of matrix resin. Melt kneading of polar high thermoplastics, thermoplastics with

lower polarity, and conductive inorganic bulking agent is carried out more collectively, And by choosing the ratio of the volume fraction of two sorts of thermoplastics, and the ratio of the viscosity at the time of kneading so that the following expression of relations (1) may be satisfied, polar high thermoplastics serves as a matrix into the constituent of this invention more, and the sea island structure which forms the continuous phase of mesh shape and exists can be taken.

$(phi_2/phi_1) x(eta_1/eta_2) <1$ (1)

phi_1: -- volume fraction phi_2: of polar high thermoplastics -- volume fraction eta_1: of polar low thermoplastics -- melt viscosity eta_2: at the time of kneading of polar high thermoplastics -- the melt viscosity at the time of kneading of polar low thermoplastics -- with a volume fraction here. The rate of occupying for the volume of a certain whole phase at the time of setting the whole volume to 1 is said, and it is $phi_1+phi_2=1$. Melt viscosity is melt viscosity measured by a capillary rheometer. A volume fraction and melt viscosity are prescribed by the temperature at the time of kneading, and the shear rate. A conductive inorganic bulking agent is selectively taken in by the matrix which consists of polar higher thermoplastics, and can form conductive circuits in a matrix.

[0019]As an example of the manufacturing method of the sea island structure of the constituent of another this invention, rubber is used for ** domain and the method of manufacturing the thermoplastics and rubber as a matrix by the dynamically vulcanization which vulcanizes rubber at the time of kneading is illustrated. If a conductive inorganic bulking agent is blended after vulcanizing thermoplastics and rubber dynamically beforehand, a conductive inorganic bulking agent will not be taken into the rubber by the side of the already vulcanized domain, but will be taken into the thermoplastics which is a matrix more nearly selectively. The constituent which the conductive inorganic bulking agent taken into the matrix forms conductive circuits in a matrix, and is obtained as a result has conductivity.

[0020]First, it explains from the manufacturing method using thermoplastics with ** polarity. If it manufactures as the matrix of a constituent, and a domain using polar high thermoplastics and polar lower thermoplastics more, the inorganic bulking agent which has conductivity will be selectively taken in more with polar high thermoplastics. The condensed conductive inorganic filler can form the continuation structure of mesh shape densely. Since the area of the interface of a conductive inorganic bulking agent and resin is large in it being in the state which the conductive inorganic bulking agent distributed in resin, therefore surface free energy is also large when thermoplastics is held at the temperature from which molecular motion becomes active, If possible, surface free energy is decreased and condensation of a conductive inorganic bulking agent takes place as like. As a result, the conductive inorganic bulking agent can form the conductive circuits of mesh shape too. More, polar high thermoplastics fills the

above-mentioned expression of relations (1), and forms a continuous phase in the whole conductive resin composition (the constituent of this invention obtained by ** is hereafter called resin composition of this invention) of this invention, When a conductive inorganic bulking agent condenses, conductive circuits are formed in the resin composition of this invention, and the resin composition of this invention comes to have conductivity.

[0021]As thermoplastics which has the polarity which forms a matrix (continuous phase) here, Also in the thermoplastics mentioned above as matrix resin, it has in polymers a substituent which has oxygen, nitrogen, sulfur, halogen, etc., Or thermoplastics with the polarity which there is an electric bias and has an electrical dipole in polymers as a result is chosen by having these atoms in a chain. If it is thermoplastics which has polarity, there will be no restriction in particular.

[0022]As thermoplastics which it has, the above-mentioned polarity specifically, Polyamide resin; polyacrylate resin; polyetherimide resin of nylon 6, 66, 610 and 612, and 11 grades; Polybutylene terephthalate, A polybutylene terephthalate isophthalate copolymer, polyethylene terephthalate, A polyethylene terephthalate isophthalate copolymer, polycyclohexanedimethanolterephthalate, poly alkyl terephthalate resin [, such as a polycyclohexanedimethanolterephthalate isophthalate copolymer,]; -- poly alkyl naphthalate resin [, such as polyethylenenaphthalate,]; -- polyvinyl acetate resin; -- polyester resin etc. are mentioned.

[0023]Although it has polarity as polar low thermoplastics from the thermoplastics of a matrix which forms a domain (disperse phase), even if it is thermoplastics lower than the thermoplastics of a matrix, it may be thermoplastics which hardly has polarity. Although the thermoplastics illustrated as thermoplastics which forms an above-mentioned matrix, and the same resin can be used as a kind of thermoplastics which forms a domain, As thermoplastics which polarity is low or hardly has polarity as a desirable example, For example, AAS, AES, AS, ABS, halogenation polyethylene, Fluoro-resins, such as halogenation polypropylene and polytetrafluoroethylene, Pori Tschirren, such as high density polyethylene (HDPE), low density polyethylene (LDPE), and straight-chain-shape low density polyethylene (LLDPE), polypropylene, polybutadiene, polyvinyl chloride, polystyrene, etc. are mentioned.

[0024]As a combination of matrix resin of the resin composition of this invention, and domain resin, the combination of nylon 6 and HDPE is illustrated, for example.

[0025]Although there is no restriction in particular in the rate of matrix resin and domain resin in the resin composition of this invention, it is more preferred that the weight ratios of matrix resin and domain resin are 70 / 30 - 30/70. If it is this range, the specific gravity of the resin composition of this invention obtained will be small, and again, Matrix resin can exist in mesh shape in domain resin as a continuous phase, and the resin composition of this invention can obtain sufficient conductivity by containing a conductive inorganic bulking agent in a matrix at

least.

[0026]** In a manufacturing method, the resin composition of this invention can be manufactured by kneading uniformly above-mentioned matrix resin, domain resin, a conductive inorganic bulking agent, and the additive agent mentioned above if needed with kneading machines, such as a mixer, for example, and supplying and carrying out melt kneading to the extrusion machine of one axis or two axes. After making the resin composition of kneaded this invention into a pellet, shaping may be presented with it, and it may be fabricated directly.

[0027]Next, the manufacturing method of ** is explained. ** In a manufacturing method, the conductive resin composition (the constituent of this invention obtained by ** is hereafter called elastomer composition of this invention) of this invention obtained, It has the sea island structure which consists of a matrix (continuous phase) of thermoplastics, and a domain (disperse phase) of rubber where at least the part was vulcanized, and a conductive inorganic bulking agent is contained in a matrix at least. By the same phenomenon as it has a conductive inorganic bulking agent and this conductive inorganic bulking agent condenses in the matrix of the resin composition of above-mentioned this invention in the elastomer composition of this invention in the matrix which forms a continuous phase at least. Conductive circuits are formed by causing condensation in a matrix. If voltage is applied to the elastomer composition of this invention, an electron will flow through a matrix via these conductive circuits. For this reason, the elastomer composition of this invention can have conductivity.

[0028]The sea island structure which the rubber which is a disperse phase distributes in the thermoplastics which is a continuous phase, As mentioned above, if a conductive inorganic bulking agent is blended after being able to manufacture thermoplastics and rubber by the dynamically vulcanization which vulcanizes rubber at the time of kneading, vulcanizing thermoplastics and rubber dynamically and manufacturing a thermoplastic elastomer composition, A conductive inorganic bulking agent is not taken into the already vulcanized rubber, but is taken into the thermoplastics which is a matrix more nearly selectively. The conductive inorganic bulking agent which is unevenly distributed in a matrix forms conductive circuits in a matrix, and, as a result, the elastomer composition of this invention has conductivity.

[0029]As thermoplastics which forms the matrix (continuous phase) of the elastomer composition of this invention, various kinds of thermoplastics or the constituent of those is available. That is, even if it is independent thermoplastics or a constituent, it may be a constituent which consists of those mixtures. Specifically Polyolefin resin; nylon 6, such as polyethylene, polypropylene, and polybutadiene, 66, 610 and 612, polyamide resin; polyester resin;AAS of 11 grades, Polystyrene system resin, such as AES, AS, and ABS, polyacrylate resin, Thermoplastic elastomer, such as fluoro-resins, such as polyvinyl system resin, such as

polymethacrylate resin, polyvinyl chloride, and chlorinated polyvinyl chloride, and polytetrafluoroethylene, imide system resin, a styrene system, an olefin system, a polyester system, and a urethane system, etc. can be mentioned.

[0030]As rubber which forms the domain (disperse phase) of the elastomer composition of this invention, as mentioned above, various kinds of rubbers are available. concrete -- diene system rubber and its hydrogenation thing (for example, NR and IR.) Epoxidation crude rubber, SBR, BR (high cis- BR and low cis- BR), NBR, hydrogenation NBR, hydrogenation SBR, olefin system rubber. for example, ethylene-propylene rubber (EPDM, EPM) and maleic acid denaturation ethylene-propylene rubber (M-EPM). IIR, isobutylene, aromatic vinyl, or a diene system monomer copolymer, Acrylic rubber (ACM), an ionomer, halogen-containing rubber. for example, Br-IIR, Cl-IIR, and the bromination thing (BIMS) of an isobutylene PARAME chill styrene copolymer. CR, hydrin rubber (CHR), chlorosulfonated polyethylene (CSM), Chlorinated polyethylene (CM), maleic acid denaturation chlorinated polyethylene (M-CM), Silicone rubber (for example, methylvinyl silicone rubber, methylphenyl vinyl silicone rubber), ** sulfur rubber (for example, polysulfide rubber), fluorocarbon rubber. (for example, vinylidene fluoride system rubber, fluorine-containing vinyl ether system rubber and fluorine-containing phosphazene system rubber), and thermoplastic elastomer (for example, a styrene system elastomer, an olefin system elastomer, and an ester system elastomer.) A urethane system elastomer and a polyamide system elastomer are mentioned. In addition to rubber, additive agents, such as a bulking agent, may be blended with a domain.

[0031]As a suitable combination of matrix resin of the elastomer composition of this invention, and the rubber of a domain, polypropylene, EPDM and polyethylene, EPDM and nylon 6, IIR, etc. are mentioned, for example.

[0032]As for the rate of the thermoplastics which forms the matrix of the elastomer composition of this invention, and the rubber which forms a domain, it is more preferred that the weight ratios of matrix resin and the rubber of a domain are 70 / 30 - 30/70. If it is this range, the specific gravity of the elastomer composition obtained will be small, and again, Matrix resin can exist in mesh shape in the rubber of a domain as a continuous phase, and the elastomer composition of this invention can obtain sufficient conductivity by containing a conductive inorganic bulking agent in a matrix at least.

[0033]In the elastomer composition of this invention, the rubber by which at least the part was vulcanized in thermoplastics has sea island structure distributed to detailed particle state. In order for the rubber which is a disperse phase to distribute in the thermoplastics which is a continuous phase, it is made for the volume fraction (phi) and melt viscosity (eta) of thermoplastics and rubber to fill the following relations.

Melt-viscosity eta_D of the volume-fraction eta_M:continuous phase of the volume-fraction phi_D:disperse phase of the inside of $alpha=(phi_D/phi_M)/(eta_M/eta_D)$ <1 type, and a

phi_M:continuous phase: Express the melt viscosity of a disperse phase. A volume fraction and melt viscosity are synonymous with the volume fraction and melt viscosity in the resin composition of above-mentioned this invention.

[0034]The sea island structure in the elastomer composition of this invention is manufactured in thermoplastics and rubber by the dynamically vulcanization which vulcanizes rubber at the time of kneading. As a vulcanizing agent (cross linking agent) used by this invention, There is no limitation in particular, for example, a sulfur-systems vulcanizing agent, an organic peroxide system vulcanizing agent, a phenol resin system cross linking agent, an organic-ammonium-salt system cross linking agent, a polyamine system cross linking agent, a polycarboxylic acid cross linking agent, etc. can be mentioned, it is independent about these one sort, or two or more sorts may be used together and used. As a sulfur-systems vulcanizing agent, specifically Powder sulfur, sedimentation nature sulfur, high dispersibility sulfur, Surface treatment sulfur, insoluble sulfur, dimorpholine disulfide, alkylphenol disulfide, etc. can be illustrated, for example, about 0.5-20 weight sections can be used to rubber 100 weight section. As a vulcanizing agent of an organic peroxide system, benzoyl peroxide, T-butyl hydroperoxide, 2, 4-BIKURORO benzoyl peroxide, 2,5-dimethyl- 2,5-di-tert-butyl peroxide hexane, 2,5-dimethylhexane-2,5-di(peroxyl benzoate), etc. are illustrated, for example, about 1-20 weight sections can be used to rubber 100 weight section. As a cross linking agent of a phenol resin system, the bromination thing (for example, bromination phenol) of alkylphenol resin, The mixed bridge construction system containing a halogen donor and alkylphenol resin, such as tin chloride and chloroprene, etc. can be illustrated, for example, about 1-20 weight sections can be used to rubber 100 weight section. As others, a flower of zinc (they are about five weight sections to rubber 100 weight section), magnesium oxide (they are about four weight sections to rubber 100 weight section), Litharge (they are about 10-20 weight sections to rubber 100 weight section), p-quinonedioxime, p-dibenzoyl quinonedioxime, tetrachloro-p-benzoquinone, Polly p-dinitroso benzene (they are about 2-10 weight sections to rubber 100 weight section), and methylenedianiline (they are about 0.2-10 weight sections to rubber 100 weight section) can be illustrated.

[0035]The conductive inorganic bulking agent blended with the elastomer composition of this invention is blended after forming above-mentioned sea island structure. By having already vulcanized the rubber which is a disperse phase, if sea island structure is fixed, The conductive inorganic bulking agent which the conductive inorganic bulking agent was not taken into a disperse phase, but was taken into the thermoplastics which is a continuous phase selectively, and was taken into the continuous phase forms conductive circuits in a continuous phase, and, as a result, the elastomer composition of this invention has high conductivity. On the contrary, if thermoplastics, rubber, a conductive inorganic bulking agent, and a vulcanizing agent are mixed and dynamically vulcanization is performed before forming sea island

structure, a conductive inorganic bulking agent will be taken not only into the thermoplastics which is a continuous phase but into the rubber which is a disperse phase, and the conductivity of the elastomer composition obtained will become low. If rubber and a conductive inorganic bulking agent are mixed and it vulcanizes by subsequently adding thermoplastics and a vulcanizing agent, the elastomer composition obtained will contain many conductive inorganic bulking agents by the inside of the rubber which is a disperse phase, therefore conductivity will become still lower.

[0036]The thermoplastics above-mentioned to the elastomer composition of this invention, rubber, a conductive inorganic bulking agent, In addition to a vulcanizing agent, if needed Rubber accelerator; stearic acid, such as 2-mercaptobenzothiazole and N-t-butyl-2-benzothiazolyl full FEN amide, Vulcanization supplement accelerators, such as zinc stearate; Carbon black for reinforcement other than the above-mentioned conductive carbon, Bulking agents, such as clay, talc, and calcium carbonate; plasticizer;N-phenyl- N', such as paraffin oil -(1,3-dimethyl)- P-phenylene diamine, Antiaging agents, such as N-phenyl-N'-isopropyl-p-phenylene diamine; the combination drug of others, such as a thermostabilizer, light stabilizer, lubricant, and colorant, may be added.

[0037]In manufacture of the elastomer composition of this invention, although there is no limitation in particular in the model used for kneading, a screw extruder, a kneader, the Bambari mixer, a biaxial extruding kneading machine, etc. are illustrated. Especially, when dynamic bridge formation is considered as kneading, it is preferred to use a biaxial extruding kneading machine. Two or more kinds of kneading machines may be used, and it may knead one by one.

[0038]The elastomer composition of this invention kneads additive agents other than the additive agent of a vulcanizing agent if needed to the rubber which forms a domain (disperse phase) beforehand, and This rubber, It can manufacture by what is called dynamically vulcanization that adds the vulcanizing agent which makes rubber vulcanize and is made to vulcanize dynamically during kneading, carrying out melt kneading of the other additive agents to thermoplastics with a 2 axis extruding kneading machine etc. if needed, and distributing rubber in thermoplastics. Although what is necessary is just to determine suitably a kind, dynamic vulcanization conditions (temperature, time), etc. of a vulcanizing agent according to the kind of rubber and there is no limitation in particular, for example as conditions which perform dynamically vulcanization, the conditions [shear rate / the temperature of 150-300 ** and] 500 to 7500 second $^{-1}$ can be illustrated.

[0039]The constituent of this invention manufactured by the manufacturing method etc. by which more than was illustrated, Suppose that it is possible to carry out decrease in specific gravity as the whole constituent by lessening the conductive inorganic bulking agent which enlarges the volume fraction of a domain, makes the volume fraction of a continuous matrix

small, blends with a matrix by this, and forms conductive circuits. By carrying out decrease in specific gravity, the weight of the product using the constituent of this invention, for example, a heating element, and an electromagnetic wave shield is mitigable.

[0040]By taking the above-mentioned composition, the constituent of this invention does not need a special device for manufacture, but it can manufacture simple, and it is low specific gravity and has the outstanding conductivity. Volume specific resistance values are 10^{-5} - 10^{3}. Especially the constituent of this invention of a certain this invention is excellent in conductivity by [omega-cm]. The constituent of this invention whose conductive inorganic bulking agents to contain are a conductive metal and conductive carbon can have the easily outstanding conductivity. As an electromagnetic shielding material, the constituent of this invention is preferred and Therefore, the charged roller of various kinds of OA equipment, An antistatic sheet, an electric conduction belt, a cleaner, an apparatus panel cover, a clean room inner package, the housing for IC associated part and IC products, a fuel tank, the electrode for sensors, an earth rod, and antistatic -- business -- it can use suitably as a hose inner tube, an outer tube, structural flooring, etc., and is suitable also as a heating element (surface state).

[0041]

[Example]Hereafter, an example is shown and this invention is explained concretely.

(Examples 1-5) The domain (EPDM) shown in Examples 1-5 of the 1st table of the following was pelletized in the pelletizer for rubbers set as 100 **. Subsequently, with the compounding ratio shown in the 1st table rubber pellets and the pellet of matrix resin, After supplying and carrying out melt kneading from the 1st feeder of a biaxial extruding kneading machine, the rubber distributed as a domain in resin as a matrix was dynamically vulcanized by throwing in continuously sulfur, a flower of zinc, stearic acid, and an antiaging agent from the 3rd feeder. Kneading conditions were shear rate about 1000-second $^{-1}$ for [kneading temperature / of 200-250 ** /, and mixing time] 3 minutes, they ended dynamically vulcanization, water-cooled and cut the constituent breathed out from the biaxial extruding kneading machine, and obtained the pellet of the thermoplastic elastomer composition. Next, the conductive inorganic bulking agent was blended with the obtained pellet, and after kneading for 10 minutes by the kneader, it took out. It was considered as the sheet of 2-mm thickness with a 200 more ** press, and a volume specific resistance value and specific gravity were measured. Measured value is shown in the 1st table. When the done sheet was cut and distribution of the conductive inorganic bulking agent was investigated under the transmission type microscope, it existed in the matrix side.

[0042](Example 6) The matrix resin shown in Example 6 of the 1st table of the following, and the pellet of a domain, After having carried out the dry blend of the conductive inorganic bulking agent, supplying from the 1st feeder of the biaxial extruding kneading machine and

carrying out melt kneading by shear rate 1000-second $^{-1}$ for 3 minutes at 230 **, the constituent breathed out from the biaxial extruding kneading machine was water-cooled and cut, and was pelletized. Next, it pressed at 240 ** like Example 1, the sheet of 2-mm thickness was produced, and the volume specific resistance value was measured. Specific gravity was also measured. Measured value is shown in the 1st table. The matrix side was suited when distribution of the conductive inorganic bulking agent was investigated like Example 1.

[0043](Comparative example 1) The matrix resin shown in the comparative example 1 of the 1st table of the following, and the pellet of a domain, The dry blend of a conductive inorganic bulking agent (carbon black), and a vulcanizing agent (sulfur) and other additive agents was carried out beforehand, it supplied from the 1st feeder of the biaxial extruding kneading machine, and kneading and dynamically vulcanization were performed by shear rate about 1000-second $^{-1}$ for [kneading temperature / of 200-250 ** /, and mixing time] 3 minutes. The obtained constituent was fabricated on the sheet of 2-mm thickness like the example, and the volume specific resistance value was measured, and specific gravity was also measured. Measured value is shown in the 1st table. When carbon distribution was measured, it existed in both matrix and domain side uniformly.

[0044](Comparative example 2) Beforehand, by the direct vent type Bambari mixer, at the initial temperature of 40 **, it mixed for 3 minutes, and the rubber and the conductive inorganic bulking agent (carbon black) of the domain were pelletized by the rubber pelletizer after that. Next, the dry blend of the rubber, matrix resin, the vulcanizing agent (sulfur), and other additive agents containing a conductive inorganic bulking agent was carried out, it supplied from the 1st feeder of the biaxial extruding kneading machine, and kneading and dynamically vulcanization were performed by shear rate about 1000-second $^{-1}$ for [kneading temperature / of 200-250 ** / and mixing time] 3 minutes. The obtained constituent was fabricated on the sheet, and the volume specific resistance value was measured, and specific gravity was also measured. Measured value is shown in the 1st table. Carbon distribution concentrated and existed in the rubber of a domain.

(Comparative example 3) It water-cooled, cut and pelletized, after having carried out the dry blend of matrix resin and the conductive inorganic bulking agent, supplying from the 1st feeder of the biaxial extruding kneading machine and carrying out melt kneading for 3 minutes at 20 **. The constituent was used as the sheet of 2-mm thickness with a press like the example, and measured a volume specific resistance value and specific gravity. Measured value is shown in the 1st table.

[0045]

[Table 1]

第 1 表

		実施例1	実施例2	実施例3	実施例4	実施例5	実施例6	比較例1	比較例2	比較例3
マトリクス樹脂	PP	30	30	30	30	30		30	30	100
	ナイロン6						30			
ドメイン	EPDM	70	70	70	70	70		70	70	
	HDPE						70			
加硫剤	イオウ	0.7	0.7	0.7	0.7	0.7		0.7	0.7	
	亜鉛華	3.5	3.5	3.5	3.5	3.5		3.5	3.5	
	ステアリン酸	1.4	1.4	1.4	1.4	1.4		1.4	1.4	
	老化防止剤	0.7	0.7	0.7	0.7	0.7		0.7	0.7	
導電性無機充填剤	カーボンブラック	10	30	50			40	30	30	
	銅粉				90					132
	カーボン繊維					30				
混合方法		ドメインとマトリクス樹脂と加硫剤で熱可塑エラストマーを作った後、導電性材料を混ぜる					3種を同時に混ぜる	4種を同時に混ぜる	(＊1)	2種を同時に混ぜる
体積個有抵抗値（Ωcm）		2.0E+01	3.0E+00	8.0E-01	1.00E-02	2.0E-02	2.0E+00	4.00E+04	6.00E+07	2.00E-01
比重		1.06	1.13	1.21	1.73	1.14	1.11	1.13	1.13	2.21

＊1 ドメインと導電材料を混ぜた後、マトリクス樹脂と加硫剤を混ぜる

[0046](Example 7, the comparative example 4)
<Electromagnetic wave shielding effect examination> By 200 ** press forming, the constituent of Example 3 and the comparative example 2 was fabricated to the 0.2-mm-thick sheet shaped. The shielding effect of electromagnetic waves was measured for this with the electromagnetic wave sensing device (Military Standard 285). Electromagnetic waves (500 MHz) were applied to the sheet shaped constituent, and the extinction ratio at the time of penetrating the sheet of electromagnetic waves was measured as shield nature according to the formula of 20xlog (V1/V2) from the voltage V1 of input electromagnetic waves, and the voltage V2 which penetrated the sheet and was measured by the electromagnetic wave detector. A result is shown in the 2nd table.
[0047]
[Table 2]

第 2 表

	実施例7	比較例4
シート種類	実施例3材料	比較例2材料
厚み（mm）	0.2	0.2
シールド効果（dB）	25	2

[0048](Example 8, the comparative example 5)

The temperature gradient [**] of the after before fabricating the constituent obtained by the <exothermic test> example 2 and the comparative example 2 to 150 mm x 150 mm, and a 2-mm-thick sheet shaped, attaching an electrode, applying the voltage of 100V for 5 minutes and applying voltage was measured. A result is shown in the 3rd table.

[0049]

[Table 3]

第 3 表

	実施例 8	比較例 5
シート種類 上昇温度（℃）	実施例 2 材料 15	比較例 2 材料 0

[0050]The compound used by the example and the comparative example is as follows.

PP: Tokuyama polypropylene RB121D (made by Tokuyama)

Nylon 6: Amilan CM1001 (made by Toray Industries, Inc.)

EPDM: Mitsui EPT4021 (made by Mitsui Chemicals, Inc.)

HDPE: High ZEKKUSU 2100J (made by Mitsui Chemicals, Inc.)

Copper powder: KE11 defined by JIS H 2114 was used.

Carbon black: Ketchen black EC (made by AKZO)

Carbon fiber: 9 mm of carbon chopped fiber length (made by Toray Industries, Inc.)

Sulfur: Powder sulfur (made by the Karuizawa refinery company)

Flower of zinc: Flower of zinc No. (made by a right anabolism study company) 3

Stearic acid: Bead stearic acid NY (made by Nippon Oil & Fats Co., Ltd.)

Antiaging agent: Antigen RD-G (made by Sumitomo Chemical Co., Ltd.)

[0051]

[Effect of the Invention]By this invention, by mixing a conductive inorganic bulking agent in the matrix side selectively at least, by low specific gravity. A conductive thermoplastic resin composition with high conductivity can be obtained, this conductive thermoplastic resin composition is excellent in electromagnetic wave shielding, and it excels also in febrility, therefore the conductive thermoplastic resin composition of this invention is used suitably for a heating element, an electromagnetic shielding material, etc.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A conductive thermoplastic resin composition which contains a conductive inorganic bulking agent in thermoplastics which makes thermoplastics a matrix, has the sea island structure which makes thermoplastics and/or rubber a domain, and forms a matrix at least.
[Claim 2]Volume specific resistance values are 10^{-5} - 10^{3}. The conductive thermoplastic resin composition according to claim 1 which exists by [omega-cm].
[Claim 3]The conductive thermoplastic resin composition according to claim 1 or 2 which is at least one as which said conductive inorganic bulking agent is chosen from a group which consists of a conductive metal and conductive carbon.
[Claim 4]The conductive thermoplastic resin composition according to any one of claims 1 to 3 in which said domain is the rubber by which at least a part was vulcanized.
[Claim 5]A heating element containing the conductive thermoplastic resin composition according to any one of claims 1 to 4.
[Claim 6]An electromagnetic shielding material containing the conductive thermoplastic resin composition according to any one of claims 1 to 4.

[Translation done.]